CURRENT LITERATURE

NOTES FOR STUDENTS

Development in gymnocarpous Agaricaceae.—In a recent paper Miss DOUGLAS[1] describes the development of 7 species of gymnocarpous Agaricaceae. She studied one species of *Mycena* (*M. subalcalina*), 3 of *Hygrophorus* (*H. miniatus*, *H. nitidus*, and *H. borealis*), and 3 of *Entoloma* (*E. flavifolium*, *E. grayanum*, and *E. cuspidatum*). The general course of development is alike in all the species, the variations presented relating to specific or generic features. The fundament of the fruit body just before the differentiation of the stipe and pileus primordia is cone-shaped, homogeneous in structure, the hyphae more or less interlaced and branched, extending in general parallel with the central axis of the cone. The surface is more or less floccose from the ends of single hyphae, or minute tufts, which diverge slightly. The young fundament of *Entoloma cuspidatum* differs from that of the others in being greatly elongated in proportion to its diameter, being nearly cylindrical, or even slightly clavate, with a conoid apex. The slender, elongate fundament appears to bear a direct relation to the slender form of the mature basidiocarp, and also to the very moist habitat of the species. The specimens studied were growing in sphagnum. The rapid elongation of the fundament serves to bring the growing points out of the watery environment in which they originate at the apex of slender rhizomorphs.

The growing point for the formation of new tissue is apical, while elongation occurs in the older hyphae. The first evidence of pileus formation is a great increase in the apical hyphae which begin to diverge, thus giving to the young fundament a sheaflike form. The pileus and stipe fundaments are thus differentiated. While apical growth of the basidiocarp continues, the most active seat of new tissue formation is now shifted from the apex to the annual furrow between pileus and stem primordia, and later to the under surface and extreme margin of the pileus. This marks the origin of the hymenophore. It begins at once in the 3 species of *Hygrophorus*, but is delayed for a short time after differentiation of the stipe and pileus fundaments in *Mycena subalcalina* and in the 3 species of *Entoloma*. It is recognized by the rich protoplasmic content of the hyphae, which usually react more strongly to stains, and thus become more deeply colored. The growth direction of these hyphae of the

[1] DOUGLAS, GERTRUDE E., The development of some exogenous species of agarics. Amer. Jour. Bot. 5:36–54. *pls.* 1–7. 1918.

hymenophore primordium is perpendicular to the point of their origin, whether over the upper end of the stem, in the angle between stem and pileus, or on the undersurface of the pileus. Their course is parallel, although in the angle of the furrow there is more or less of a convergence in their growth direction. At first these hyphae are very slender and terete, but later they become stouter and blunt. From the time of their origin they form a palisade layer whose surface is, in general, level until gill formation begins. In the majority of the species, the ends of the hyphae soon reach the same level. Their "register" is even, and the surface compact; but in *Hygrophorus miniatus* and *H. nitidus* the palisade for some time is not compact and the hyphae do not register evenly. The even register of the palisade hyphae is delayed in these species for some time after the origin of the gill salients.

During the early stages of development of the hymenophore there is a strong epinastic growth of the pileus margin, causing it to curve downward and inward. This is particularly strong in most of the species, less so in *Entoloma cuspidatum* and less so in *Hygrophorus nitidus*. The gill salients are formed by the more rapid downward growth and extension of the subjacent tissue in regularly spaced radial areas. The development advances in a peripheral direction from the stem toward the margin of the pileus. The growth direction is perpendicular to the morphological undersurface of the pileus, and the situation from this standpoint can readily be understood when the pileus margin is strongly incurved.

In the palisade layer, which eventually becomes the hymenium, the elements are multiplied by branching of the subhymenial elements. In the species of *Hygrophorus* in particular, and to some extent also in *Entoloma flavifolium*, the pressure of the increasing palisade loosens up the elements of the subhymenium, and this is evident as a zone of less density. This peculiarity is well shown also in *Omphalia chrysophylla* and *Clitocybe cerussata* studied by BLIZZARD.[2]

In both these papers dealing with gymnocarpous forms, it is shown that the origin and the general course of development of the hymenophore corresponds with that of angiocarpous forms of the *Agaricus* type. It is further shown that there is a tendency in the early stages of development for a superficial zone of the pileus, here of quite limited extent, to be arrested in growth, sometimes quite regularly and normally. The regular course of development being thus shifted to a slightly interior zone presages the later evolutionary type of development presented by the angiocarpous forms, where the origin and differentiation of stipe and pileus primordia are shifted permanently to the interior of the young basidiocarp primordium, with a more or less well marked external zone, the blematogen.—GEO. F. ATKINSON.

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[2] BLIZZARD, A. W., The development of some species of agarics. Amer. Jour. Bot. 4:221–240. *pls. 6–11.* 1917.